

RISK-BASED DECISION-MAKING GUIDELINES

Volume 1

**Risk-based Decision-making
Navigator**

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Risk Management Is a Cornerstone in the Coast Guard Marine Safety and Environmental Protection Business Plan (FY2001-2005)



1.0 Risk Management within the Coast Guard

Risk assessment and risk management are hot topics in industry and government. Because of limited resources and increasing demands for services, most organizations simply cannot continue business as usual. Even if resources are not decreasing, the need for continuous improvement drives change within most organizations. These same conditions exist within the United States Coast Guard (Coast Guard) and within the marine industry as a whole.

The need to do more requires that the Coast Guard best use its limited resources for the good of a broad constituency of stakeholders. The Coast Guard has identified risk management as a critical tool for achieving this objective. In the Coast Guard Marine Safety and Environmental Protection Business Plan (FY2001-2005), risk management is one of five capabilities needed to achieve the Coast Guard's strategic goals.

The goal of the risk management capability is to do the following:

Establish risk-based decision making as a core competency to provide for enhanced decision making and further progress toward achieving organizational goals

Most Common MSO Risk-based Decision-making Applications

- **Prevention-related decisions**
 - ◆ **managing port and waterway operations**
 - ◆ **conducting inspections**
- **Preparedness-related decisions**
- **Response-related decisions**

The Coast Guard wants decision makers to use tools that will help them consider risk in their decisions. Though risk-based decision making is universally applicable across the Coast Guard, the emphasis of the *Risk-based Decision-making Guidelines* is on marine safety. The figure on the following page illustrates many of the most common marine safety risk-based decision-making applications.

By using risk management tools, the Coast Guard will better focus its own resources and the attention of the marine industry on the most significant risks. The results should be effective loss prevention in the marine industry, the best use of Coast Guard resources, and greater dialogue among stakeholders about risks in the marine industry.

The *Risk-based Decision-making Guidelines* describe the Marine Safety and Environmental Protection (G-M) risk management toolbox. The concepts, tools, and examples in the *Guidelines* provide proven methods for addressing real decision-making needs. Decision makers throughout the Coast Guard will find the insights, suggestions, and procedures in the *Guidelines* valuable in the conduct of operations.

Prevention-related Decisions

Managing Port and Waterway Operations

- What actions should be taken to address port and waterway operations posing the greatest risk to safety and environmental protection?
- What actions will minimize risk for specific operations or systems of special concern?
- How can the risk of upcoming changes in port and waterway operations best be managed?
- Does a proposed alternative compliance strategy provide the same level of protection as the established requirements?
- How should the CG plan monitoring and surveillance activities to minimize risks?

Conducting Inspections

- Which types of inspections should a unit emphasize to minimize risk?
- What should a unit inspect? How should CG resources best be allocated among various vessels and facilities?
- Which evaluation points should a unit emphasize during an inspection?
- What actions should be taken in response to a recognized deficiency?

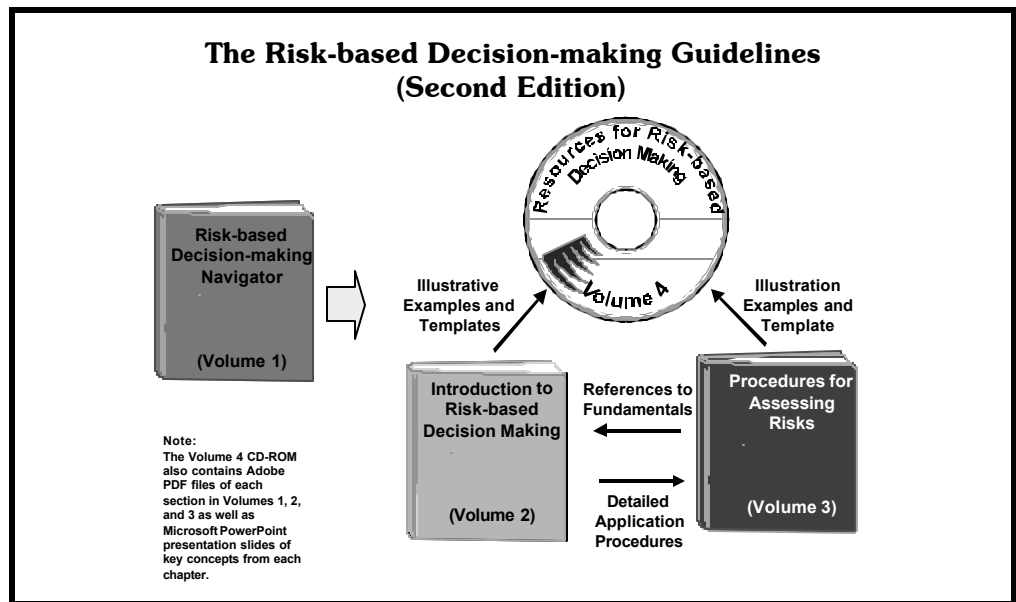
Preparedness-related Decisions

- What accidents or locations should a unit emphasize in response planning?
- What strategies will minimize the risk associated with a specific accident scenario?

Response-related Decisions

- What investigative actions should be taken to prevent recurrence of accidents?
- What actions should be taken to minimize operational risks during response actions?

Note: These decision-making activities are described in detail in Volume 3, Chapter 1 of these *Guidelines*. This chapter also (1) indicates the typical risk-related information needed to answer each question and (2) suggests risk assessment approaches for effectively and efficiently developing the needed information in various situations.



2.0 Overview of the Second Edition of the *Guidelines*

The second edition of the *Guidelines* is greatly expanded. Its four key parts include 12 field-tested and proven risk assessment tools to support the most common USCG marine safety decisions. Volume 1 will help steer you through the *Guidelines*. Step-by-step guidance in the selection and application of risk assessment tools is provided in Volumes 2 and 3. Completed examples of each risk assessment tool are provided in Volume 4 on CD-ROM.

2.1 Volume 1: *Risk-based Decision-making Navigator*

Volume 1 of the *Guidelines*, which you are now reading, provides a map to help guide you. Whatever your specific reason for opening the *Guidelines*, the *Navigator* will help you find the specific advice, guidance, and examples you need.

2.2 Volume 2: *Introduction to Risk-based Decision Making*

Volume 2 of the *Guidelines* has the following seven chapters, which provide the basics of risk-based decision making and explain key steps in the process:

Basic Principles

Chapter 1: “Principles of Risk-based Decision Making”

Chapter 2: “Principles of Risk Assessment”

Chapter 3: “Principles of Risk Management”

Chapter 4: “Principles of Risk Communication”

Overview of Assessment Tools

Chapter 5: “Decision Analysis Tools”

Chapter 6: “Risk Assessment Tools”

Chapter 7: “Acronym List and Glossary of Terms”

2.3 Volume 3: Procedures for Assessing Risks

Volume 3 of the *Guidelines* has many chapters that provide specific steps for (1) getting started with risk assessment applications and (2) using specific risk assessment tools:

Getting Started with Risk Assessment

Chapter 1: Selecting an Appropriate Risk Assessment Approach

Chapter 2: Managing a Risk Assessment Project

Applying Risk Assessment Tools

Chapter 3: Pareto Analysis

Chapter 4: Checklist Analysis

Chapter 5: Relative Ranking/Risk Indexing

Chapter 6: Preliminary Risk Analysis (PrRA)

Chapter 7: Change Analysis

Chapter 8: What-if Analysis

Chapter 9: Failure Modes and Effects Analysis (FMEA)

Chapter 10: Hazard and Operability (HAZOP) Analysis

Chapter 11: Fault Tree Analysis (FTA)

Chapter 12: Event Tree Analysis (ETA)

Chapter 13: Event and Causal Factor Charting

Chapter 14: Preliminary Hazard Analysis (PrHA)

2.4 Volume 4: Resources for Risk-based Decision Making

Volume 4 of the *Guidelines* is an electronic library of resource materials related to risk-based decision making. *Resources for Risk-based Decision Making* contains a wealth of information, such as the following:

- More information on the specific risk assessment tools discussed in the *Guidelines*
- Information on other risk assessment methods and tools
- Example risk assessment reports from the field

- A data sources compendium to help field users find data for risk assessments
- Job aids, such as checklists on various topics, to make risk assessments more effective or efficient
- Electronic versions of materials from the *Guidelines*

The Evolution of the *Guidelines*

- **The first edition of the *Risk-based Decision-making Guidelines***
- **Goals for the second edition of the *Guidelines***
- **An assessment of risk-based decision making in the field**
- **Acknowledgment of the participation of field units**

3.0 The Evolution of the *Guidelines*

3.1 The first edition of the *Risk-based Decision-making Guidelines*

In January 1997, G-M released a newly prepared document, *Risk-based Decision-making Guidelines*. That document outlined a suggested risk-based decision-making process and described a few risk management techniques applicable to marine safety offices (MSOs). G-M prepared and issued the document rapidly to provide useful guidance to field units trying to build risk-based decision making into their business plans.

3.2 Goals for the second edition of the *Guidelines*

G-M sponsored the Coast Guard's Research and Development Center (R&D Center) development of a second edition of the *Guidelines*. The goals for the second edition were the following:

- Make the format friendlier to the reader
- Provide more background about how accidents occur and the fundamentals of risk-based decision making
- Explain risk assessment tools and techniques in more detail, with simple examples to improve reader comprehension
- Define a reasonable risk toolbox mix by testing applications against specific MSO business and decision-making activities
- Explain how to decide which tool is best for a particular application in the field
- Identify and describe available data sources that can be used by units to improve decision making

- Structure the material to (1) use with training sessions on risk-based decision making and (2) allow for easy update in subsequent editions of the *Guidelines*

3.3 An assessment of risk-based decision making in the field

Later in 1997, the R&D Center began a project, sponsored by G-M, to assess the status of risk-based decision making in the field. The R&D Center teamed with EQE International, Inc. (an ABS Group Company) to survey the use of risk-based decision making at field units across the country. In that survey, the team gathered information on the effectiveness of the first edition of the *Risk-based Decision-making Guidelines* and ideas for improving the next version. The complete survey results are available from the R&D Center in a report entitled, *Results from the Assessment of Risk-based Decision-making Practices in Coast Guard Marine Safety Operations* (final version dated January 1998).

3.4 Acknowledgment of the participation of field units

MSOs completed almost 150 survey responses, representing about 50 different units and offices. These responses provided information and suggestions related to their use of the first edition of the *Guidelines*. In addition, five specific MSOs (Boston, Long Beach, New Orleans, Pittsburgh, and San Francisco) hosted visits by project team members to allow for a better understanding of their risk-based decision-making needs and their use of the first edition of the *Guidelines*. The ideas generated through the surveys and site visits provided much of the basis for the content and format of this second edition of the *Guidelines*.

The reasonable toolbox mix for this version of the *Guidelines* was shaped by our evaluation of unit experiences with risk-based decision making. Specifically, Coast Guard risk-based decision-making applications such as the Port Activity Risk Index (PARI) and Vessel Risk Index (VRI) were evaluated, best risk-based decision-making practices from the marine industry were surveyed, and new risk assessment tools were introduced and tested at several Coast Guard shore facilities. The lessons learned from these efforts have been included in this new edition of the *Guidelines*.

Field units that made key contributions by hosting onsite test applications include:

- Activities Baltimore
- MSO Buffalo/MSD Massena
- MSO Charleston
- MSO San Francisco
- MSO Mobile

- MSO Portland
- MSO Providence

These test applications helped refine and customize the risk assessment tools for Coast Guard applications and provide the project team with greater insight into the risk assessment needs of field units. The reports from these test applications are included in Volume 4 as examples of how selected tools may be applied to specific port and waterway management issues.

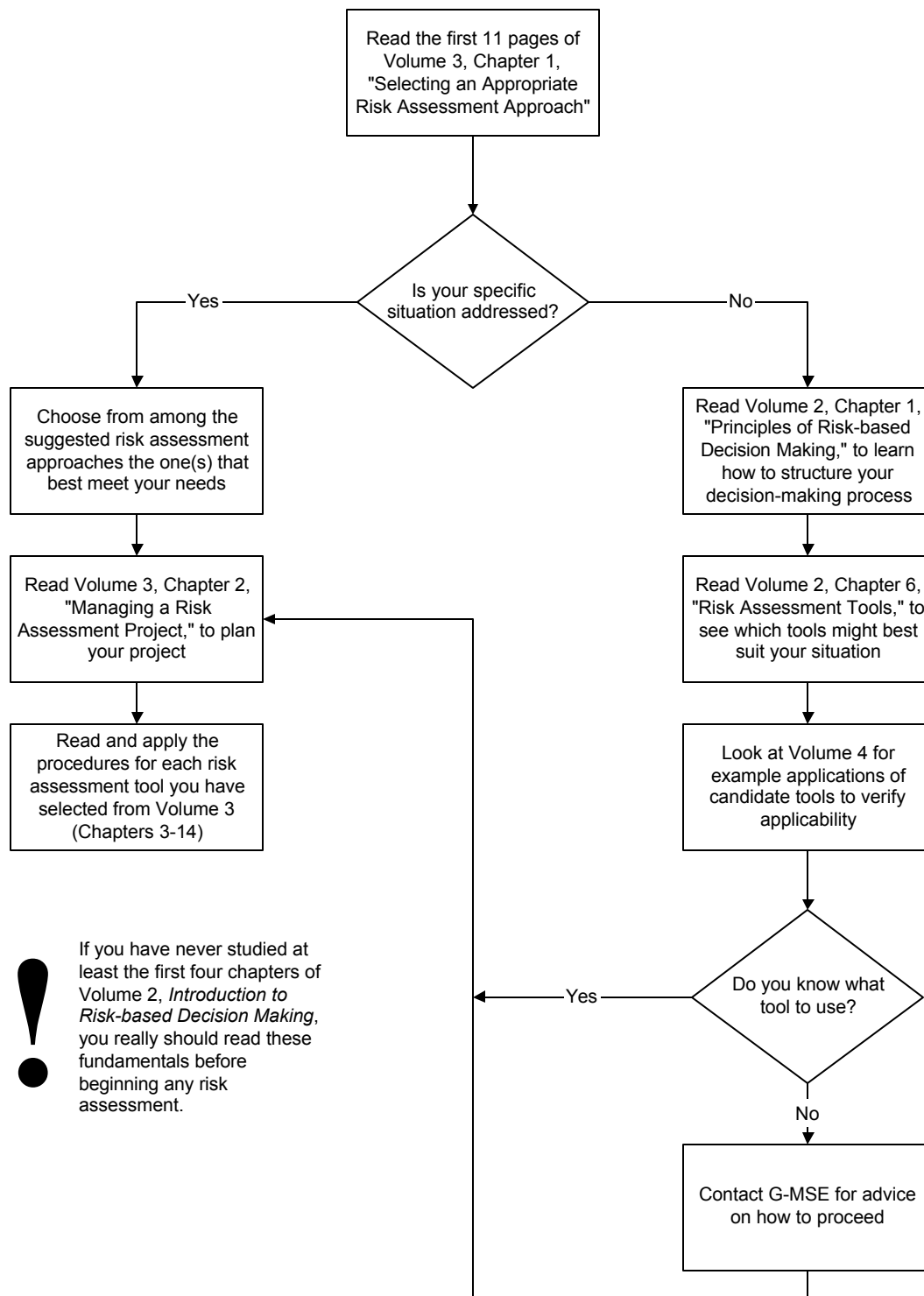
4.0 How to Use the *Risk-based Decision-making Guidelines*

4.0 How to Use the *Risk-based Decision-making Guidelines*

The following sections outline reading plans to help you quickly find the most helpful information for your particular needs.

If you have not studied the first four chapters of Volume 2, *Introduction to Risk-based Decision Making*, you should read these fundamentals before beginning any risk assessment.

4.1 If you need a quick start on a specific situation, but do not know where to begin



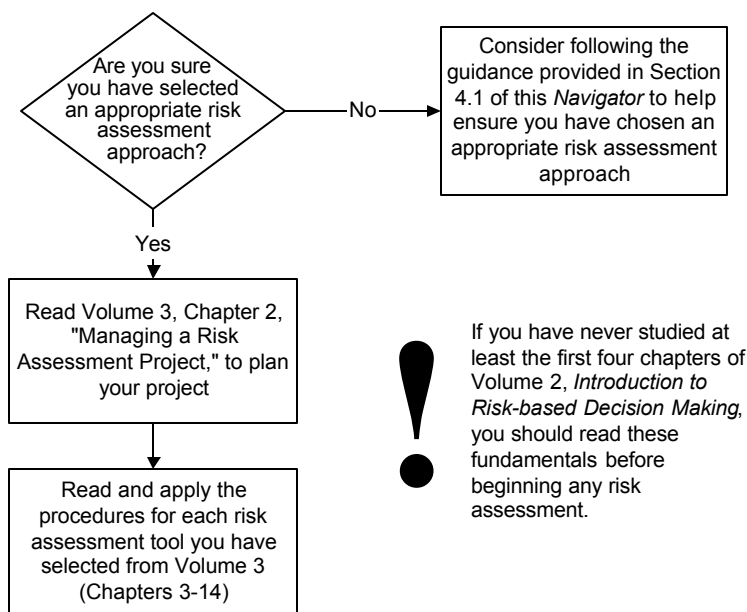
If you have a risk-based decision-making need but do not know where to begin, Volume 3, Chapter 1 provides example scenarios to which you may compare your situation. From there, you will be provided information to choose from among the suggested streamlined or advanced risk assessment approaches.

If your situation is not similar to the example scenarios, you can research the characteristics of several tools and judge their suitability to your situation. Volume 2, Chapter 1 provides a basic method that will help you structure your decision-making process. Volume 2, Chapter 6 provides an overview of various risk assessment tools and the output of such tools. These descriptions will help you determine the appropriate tools for your situation. Volume 4, *Resources for Risk-based Decision Making*, also includes completed examples of each tool and can help you better understand whether a tool can meet your needs. If you need additional assistance, contact G-MSE for advice.

After you select a risk assessment approach, read Volume 3, Chapter 2, “Managing a Risk Analysis Project.” This chapter clearly lays out the major phases of your risk assessment project and offers advice on practical implementation. You should also read and follow any procedures provided for each of the risk assessment tools you select.

Although the quick start advice will help you get your project under way, at some point you should read the fundamentals presented in Volume 2, *Introduction to Risk-based Decision Making*.

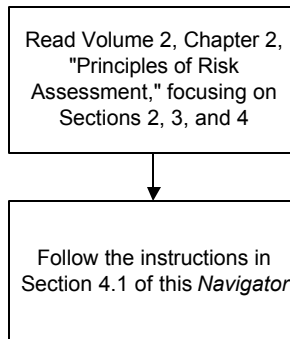
4.2 If you know what type of risk assessment to perform, but do not know what steps to follow



Open Volume 3 and read (1) Chapter 2, "Managing a Risk Assessment Project," and (2) the specific chapters that cover the risk assessment tools you will use. Then, go to Volume 4 and review resources related to each tool. This information will help you understand how to perform the type of risk assessment you have chosen.

You may also want to read Volume 3, Chapter 1, "Selecting an Appropriate Risk Assessment Approach," to verify that the risk assessment tool you have selected actually is the best choice.

4.3 If you are investigating a particular accident

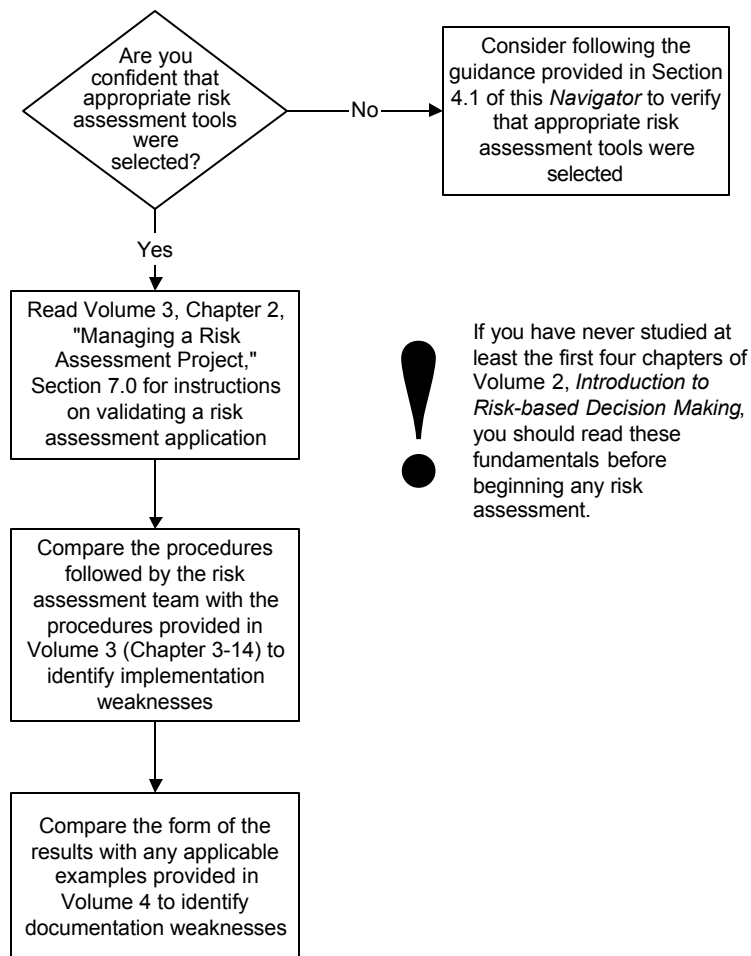


If you have never studied at least the first four chapters of Volume 2, *Introduction to Risk-based Decision Making*, you should read these fundamentals before beginning any risk assessment.

Open Volume 2, Chapter 2, and read Sections 2, 3, and 4 for an understanding of how accidents occur, the fundamentals of human error, and an overview of root cause analysis.

Next, follow the instructions in Section 4.1 of this *Navigator*, "If you need a quick start on a specific situation, but do not know where to begin."

4.4 If you are reviewing a risk assessment performed by someone else



Open Volume 3 and read Chapter 2, Section 7.0. This section provides general advice and a checklist for validating a completed risk assessment. During your review, you will need to be sure that all risk assessment tools were used appropriately by the risk assessment team. To do this, you will probably want to read the chapters in Volume 3 that correspond with the risk assessment tools that were used.

4.5 If you just want to learn more about the basics of risk-based decision making

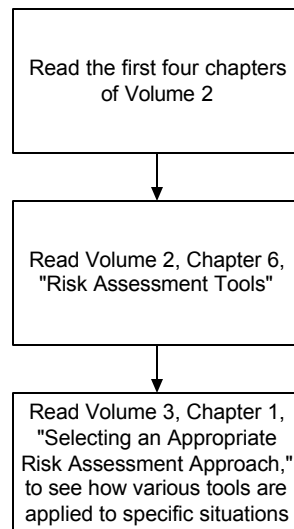
Read the first four chapters
of Volume 2

Open Volume 2 and read Chapter 1, “Principles of Risk-based Decision Making.” This chapter provides an overview of risk-based decision making and the key steps involved in the process. Depending on your level of interest, you may also want to read the following chapters:

- Volume 2, Chapter 2, “Principles of Risk Assessment”
- Volume 2, Chapter 3, “Principles of Risk Management”
- Volume 2, Chapter 4, “Principles of Risk Communication”

These four chapters should provide you with a basic understanding of risk-based decision making.

4.6 If you just want to know more about risk assessment and risk management



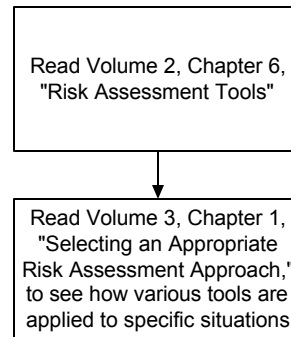
First, follow the reading plan for the basics of risk-based decision making (i.e., Volume 2, Chapters 1 through 4, with emphasis on Chapters 2 and 3).

Then, read the following:

- Volume 2, Chapter 6, "Risk Assessment Tools"
- Volume 3, Chapter 1, "Selecting an Appropriate Risk Assessment Approach"

These chapters should help you understand the basics of risk, risk assessment, and risk management without overwhelming you with details of the various risk assessment tools.

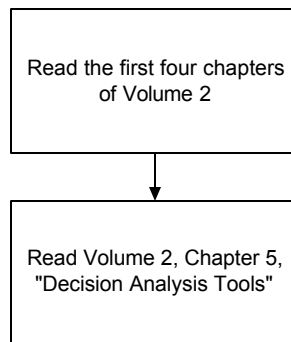
4.7 If you just want a broad overview of risk assessment tools



Open Volume 2 and turn to Chapter 6, "Risk Assessment Tools," to learn more about specific methods.

After completing your review of risk assessment tools and concepts, read Volume 3, Chapter 1, "Selecting an Appropriate Risk Assessment Approach." This chapter will provide insight into which tools work best for different situations.

4.8 If you need help structuring your overall decision-making process



Open Volume 2 and follow the reading plan for the basics of risk-based decision making (i.e., Chapters 1 through 4, with emphasis on Chapters 2 and 3).

Then, read Volume 2, Chapter 5, “Decision Analysis Tools.” This chapter provides an introduction to several decision analysis tools that should help you structure your overall decision-making process.

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Volume 1-Navigator.ppt

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Volume 2: Introduction to Risk-based Decision Making

Volume 2 Microsoft PowerPoint slides

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Volume 4: Resources for Risk-based Decision Making

General Resources

Data Sources Compendium
Operational Risk Management
Hazards, Sources, Initiating Events, & Potential Consequences
Human Error and Marine Safety
Further Information on Decision Analysis Tools
Port and Waterway Risk Assessment Guide (from GW University)
PTP Guide to Improving Communications

Root Cause Analysis Resources

Example Root Cause Analysis Report
Example Root Cause Analysis (5 Whys Analysis)
Example Root Cause Analysis (Event & Causal Factor Charting)

Tool-specific Resources

Change Analysis

Rank Risk Assessment for a Marine Event
Example Change Analysis (Raising the *HUNLEY*)

Checklist Analysis

Environmental Issues Checklist
Foreign Freight Vessel Examination Book
Example Checklist Analysis (Construction Activities)
Example Error-likely Situation Checklist (Bridge Staff)
Example Error-likely Situation Checklist (Drill Activity)

Event and Causal Factor Charting

Example Root Cause Analysis (Why a Barge Ran Aground)

Event Tree Analysis (ETA)

Example Event Trees for Oil Spray Fires on Vessels
Example ETA (Operating High-capacity Gaming Vessels)
Example ETA (Whether Stability Letters are Req'd)
Example Human Reliability Analysis Event Tree

Volume 4: Resources for Risk-based Decision Making (cont.)

Failure Modes and Effects Analysis (FMEA)

MIL-STD-1629A

Example FMEA (Specific Inspection Plans for Vessels)

Fault Tree Analysis (FTA)

Example FTA for an Oil Tanker

Example FTA (Specific Inspection Plans for Vessels)

Example FTA (Bridge Staffing Issues on Ferries).doc

Example FTA (5 Whys Analysis)

Hazard and Operability (HAZOP) Analysis

Example HAZOP Analysis of Barge Loading Operations

Example Guide Word Analysis (Drill Activity)

Pareto Analysis

Example Pareto Analysis (Marine Incidents)

Preliminary Hazard Analysis (PrHA)

Example Analysis Using PrHA (Construction Activities)

Preliminary Risk Analysis (PrRA)

Further Information on Preliminary Risk Analysis

12-step Program (from GW University)

Demonstration of a PrRA

Example PrRA (Prioritizing Risk Reduction Activities)

Example PrRA (Raising the *HUNLEY*)

Relative Ranking/Risk Indexing

Targeting of Foreign Vessels for Boardings

Ports and Waterways Safety Assessment (PAWSA)

Waterway Evaluation Tool (WET)

Rank Risk Target Risk Example Application

Example Risk Index

Example Risk Index

Example Risk Index Attach A

Example Risk Index Attach B

Example Relative Ranking (Prioritizing GSTRP Planning)

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Example Relative Ranking (Prioritizing Vessels for Insp)

What-if Analysis

General What-if Questions

Supplemental Questions for Hazard Evaluations

Detailed Hazard Analysis of ATON Deck Operations

Example What-if Analysis (Raising the *HUNLEY*)

Example What-if Analysis

Example What-if Analysis

Example What-if Analysis Attach A

Example What-if Analysis Attach B

